WHAT IS CLAIMED IS:

1. A method of increasing isoflavonoid biosynthesis in a plant comprising:
   a) down-regulating flavanone 3-hydroxylase in said plant; and
   b) up-regulating isoflavone synthase and/or the production of a substrate thereof in said plant.

2. The method of claim 1, wherein said plant comprises a mutant flavanone 3-hydroxylase gene exhibiting a loss of function with respect to a flavanone 3-hydroxylase gene lacking said mutation.

3. The method of claim 1, comprising up-regulating isoflavone synthase in said plant.

4. The method of claim 3, wherein up-regulating isoflavone synthase comprises introducing a transgene encoding said isoflavone synthase into said plant.

5. The method of claim 4, wherein introducing said transgene comprises genetically transforming said plant or a parent plant of any previous generation of said plant with said transgene.

6. The method of claim 4, wherein said isoflavone synthase comprises the polypeptide sequence of SEQ ID NO:2.

7. The method of claim 1, further defined as comprising up-regulating chalcone isomerase in said plant.

8. The method of claim 7, wherein said chalcone isomerase comprises the polypeptide sequence encoded by SEQ ID NO:3.

9. The method of claim 7, wherein up-regulating chalcone isomerase comprises introducing a transgene encoding said chalcone isomerase into said plant.

10. The method of claim 9, wherein introducing said transgene comprises genetically transforming said plant or a parent plant of any previous generation of said plant with said transgene.

11. The method of claim 7, wherein up-regulating chalcone isomerase comprises introducing a transgene encoding the PAP1 gene into said plant.

12. The method of claim 1, further defined as comprising up-regulating chalcone synthase in said plant.

13. The method of claim 12, wherein said chalcone synthase comprises the polypeptide sequence encoded by SEQ ID NO:5 or SEQ ID NO:6.

14. The method of claim 1, wherein down-regulating flavanone 3-hydroxylase comprises expression of an antisense oligonucleotide complementary to the gene encoding said flavanone 3-hydroxylase.

15. The method of claim 14, wherein said antisense oligonucleotide comprises from about 20 to about 1242 nucleotides complementary to the nucleic acid sequence of SEQ ID NO:7, from about 20 to about 815 nucleotides complementary to the nucleic acid sequence of SEQ ID NO:10 or from about 20 to about 5586 nucleotides complementary to nucleotides 82850-88437 of SEQ ID NO:8.

16. The transgenic plant of claim 15, wherein the antisense oligonucleotide is further defined as comprising from about 20 to about 780 nucleotides complementary to nucleotides 82850-83062, 83159-83406, 86908-87232, and/or 87801-88437 of SEQ ID NO:8.

17. The transgenic plant of claim 15, wherein the antisense oligonucleotide is further defined as comprising from about 20 to about 1021 nucleotides complementary to

nucleotides 82850-83062, 83159-83406, 86908-87232, and/or 87801-88043 of SEQ ID NO:8.

18. The method of claim 14, wherein introducing said selected DNA comprises genetically transforming said plant or a parent plant of any previous generation of said plant with said selected DNA.

19. The method of claim 1, wherein the plant is a monocotyledonous plant.

20. The method of 13, wherein said monocotyledonous plant is selected from the group consisting of wheat, maize, rye, rice, oat, barley, turfgrass, sorghum, millet and sugarcane.

21. The method of claim 20, wherein the monocotyledonous plant is maize.

22. The method of claim 1, wherein the plant is a dicotyledonous plant.

23. The method of claim 22, wherein said dicotyledonous plant is selected from the group consisting of tobacco, tomato, potato, soybean, cotton, canola, alfalfa, sunflower, and cotton.

24. A transgenic plant stably transformed with:

a) a first selected DNA comprising a nucleic acid encoding an antisense oligonucleotide operably linked to a promoter functional in said plant, wherein said antisense oligonucleotide comprises from about 20 to about 1242 nucleotides complementary to the nucleic acid sequence of SEQ ID NO:7, from about 20 to about 815 nucleotides complementary to the nucleic acid sequence of SEQ ID NO:10 or from about 20 to about 5586 nucleotides complementary to nucleotides 82850-88437 of SEQ ID NO:8; and

b) a second selected DNA comprising an isoflavone biosynthesis coding sequence operably linked to a promoter functional in said plant, wherein the

coding sequence encodes a polypeptide selected from the group consisting of: the polypeptide of SEQ ID NO:2, the polypeptide encoded by SEQ ID NO:3, the polypeptide encoded by SEQ ID NO:5 and the polypeptide encoded by SEQ ID NO:6.

25. The transgenic plant of claim 24, wherein said first selected DNA and/or said second selected DNA comprises an enhancer.

26. The transgenic plant of claim 24, wherein said first selected DNA and/or said second selected DNA comprises plasmid DNA.

27. The transgenic plant of claim 24, wherein said first selected DNA and/or said second selected DNA comprises a sequence encoding a signal peptide.

28. The transgenic plant of claim 24, further defined as a fertile R_0 transgenic plant.

29. The transgenic plant of claim 24, further defined as a progeny plant of any generation of a fertile R_0 transgenic plant, wherein said transgenic plant has inherited said first selected DNA from said R_0 transgenic plant.

30. The transgenic plant of claim 24, further defined as a progeny plant of any generation of a fertile R_0 transgenic plant, wherein said transgenic plant has inherited said second selected DNA from said R_0 transgenic plant.

31. The transgenic plant of claim 24, further defined as a progeny plant of any generation of a fertile R_0 transgenic plant, wherein said transgenic plant has inherited said first and said second selected DNA from said R_0 transgenic plant.

32. The transgenic plant of claim 24, wherein said first selected DNA and said second selected DNA were transformed into said plant or a progenitor thereof on a single transformation construct.

33. The transgenic plant of claim 24, wherein the antisense oligonucleotide is further defined as comprising from about 20 to about 780 nucleotides complementary to nucleotides 82850-83062, 83159-83406, 86908-87232, and/or 87801-88437 of SEQ ID NO:8.

34. The transgenic plant of claim 24, wherein the antisense oligonucleotide is further defined as comprising from about 20 to about 1021 nucleotides complementary to nucleotides 82850-83062, 83159-83406, 86908-87232, and/or 87801-88043 of SEQ ID NO:8.

35. A seed of the transgenic plant of claim 24, wherein said seed comprises said first selected DNA and said second selected DNA.

36. A method of making food for human or animal consumption comprising:

(a) obtaining the plant of claim 24;

(b) growing said plant under plant growth conditions to produce plant tissue from the plant; and

(c) preparing food for human or animal consumption from said plant tissue.

37. The method of claim 36, wherein preparing food comprises harvesting said plant tissue.

38. The method of claim 36, wherein said food is starch, protein, meal, flour or grain.

39. A method of producing a nutraceutical composition comprising

(a) obtaining the plant of claim 24;

(b) growing said plant under plant growth conditions to produce plant tissue from the plant; and

(c) preparing a nutraceutical composition for human or animal consumption from said plant tissue.

40. A method of inhibiting the initiation and promotion of a mammalian cell to a premalignant or malignant state in a mammal comprising:

(a) obtaining the plant of claim 24;

(b) growing said plant under plant growth conditions to produce plant tissue from the plant;

(c) preparing a nutraceutical composition for human or animal consumption from said plant tissue; and

(d) administering a therapeutically effective amount of the nutraceutical composition to the mammal.

41. The method of claim 40, wherein said mammal is a human.

42. The method of claim 40, wherein said administering is oral or topical.

43. A method of inhibiting the onset of cardiovascular disease in a mammal comprising:

(a) obtaining the plant of claim 24;

(b) growing said plant under plant growth conditions to produce plant tissue from the plant;

(c) preparing a nutraceutical composition for human or animal consumption from said plant tissue; and

(d) administering a therapeutically effective amount of the nutraceutical composition to the mammal.

44. The method of claim 43, wherein said mammal is a human.

45. The method of claim 43, wherein said administering is oral or topical.

46. A method of increasing isoflavonoid biosynthesis in an alfalfa plant, comprising introducing into said plant a nucleic acid sequence encoding isoflavone synthase, wherein

the nucleic acid sequence is operably linked to a promoter operable in said plant and wherein expression of the nucleic acid sequence results in an increase in isoflavonoid biosynthesis in the plant relative to a plant of the same genotype lacking said nucleic acid sequence.

47. The method of claim 46, wherein introducing the nucleic acid sequence into said plant comprises genetic transformation.

48. The method of claim 46, wherein introducing the nucleic acid sequence into said plant comprises plant breeding.

49. The method of claim 46, wherein the biosynthesis of genistein is increased in said plant relative to a plant of the same genotype lacking said nucleic acid sequence.

50. The method of claim 46, wherein the isoflavone synthase comprises the polypeptide sequence of SEQ ID NO:2.